

MULTIMEDIA



UNIVERSITY

STUDENT ID NO.

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 3, 2017/2018

**TAI2151 – ARTIFICIAL INTELLIGENCE FUNDAMENTALS**  
(All Sections/Groups)

1 June 2018  
9.00am – 11.00am  
(2 Hours)

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### INSTRUCTIONS TO STUDENTS

1. This question paper consists of 5 pages with 5 questions only.
2. Attempt **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided.

**Question 1**

(a) Many people assert that the Turing test is the only legitimate test of machine intelligence. What is a Turing test? What is the most important premise/condition to pass the Turing test? (3 marks)

(b) The most basic form of agent is purely reactive, whereas an agent based on planning or search is entirely deliberative. Describe the differences between reactive and deliberative agents. (2 marks)

(c) Answer with justification the tic-tac-toe task environment according to the following properties:

- (i) Is it fully or partially observable? (1 mark)
- (ii) Is it deterministic or stochastic? (1 mark)
- (iii) Is it episodic or sequential? (1 mark)
- (iv) Is it static, dynamic or semi-dynamic? (1 mark)
- (v) Is it discrete or continuous? (1 mark)

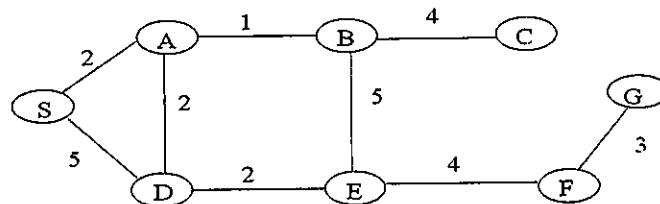
**Continued....**

**Question 2**

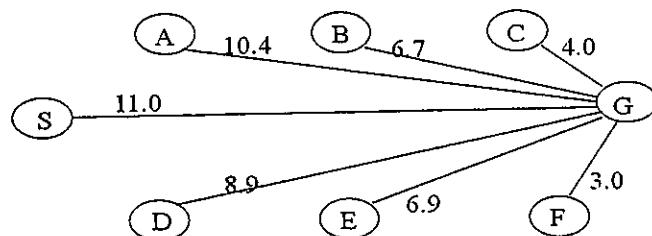
(a) What is an admissible heuristic function? (2 marks)

(b) Why the straight-line distance for each node in a graph to the goal node is an admissible heuristic function? (2 marks)

(c) Given the following map with the actual distances display on it, workout the solution path and the path cost from S to G using A\* Search.



The following figure shows the straight-line distances for each node to G:

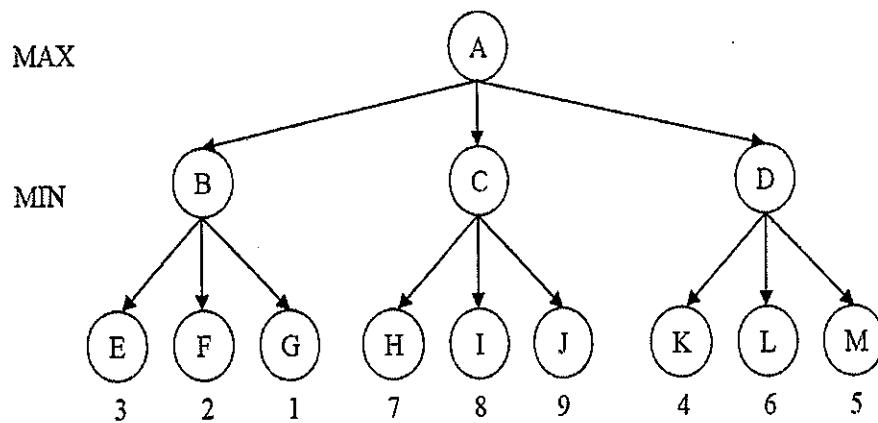


(6 marks)

**Continued....**

**Question 3**

Consider this game tree where the root is a maximizing node, and children are visited from left to right.



- (a) Compute the minimax game value of nodes A, B, C, and D using the standard minimax algorithm. (2 marks)
- (b) What move will be selected by player one using minimax? (1 mark)
- (c) List the nodes (leaves or interior nodes) that alpha-beta algorithm prunes (i.e., decides need not be examined). (2 marks)
- (d) The number of nodes that alpha-beta algorithm prunes depends on how each node's children are ordered in the tree.
  - (i) How to obtain a new game tree by re-ordering the children of each internal node, such that the new game tree is equivalent to the tree above, but alpha-beta pruning will prune as many nodes as possible?
  - (ii) List the nodes that would be pruned. (5 marks)

Continued....

**Question 4**

You are given the following predicates:

$\text{dog}(X)$  = X is a dog

$\text{animal}(X)$  = X is an animal

$\text{dies}(X)$  = X dies

(a) Translate the following English sentences into First-Order Logic statements:

1. Fido is a dog.
2. All dogs are animals.
3. All animals will die.

(2 marks)

(b) Convert the First-Order Logic statements obtained in (a) into Conjunctive Normal Form.

(2 marks)

(c) Use resolution refutation to prove that Fido will die. (6 marks)

Continued....

**Question 5**

A decision tree is used for deciding your favourite restaurant. Assume we have two types: Price and Type, where Price has three possible values: Low (L), Medium (M), and High (H); and Type has two possible values: Hamburger (H) and Vegetarian (V). Consider the following training set consisting of five examples:

Example	Attributes		Class
	Price	Type	
1	L	H	+
2	L	V	+
3	M	H	-
4	M	V	+
5	H	V	-

For your information,  $\log_2 1=0$ ,  $\log_2 2=1$ ,  $\log_2 3=1.6$ ,  $\log_2 4=2$ ,  $\log_2 5=2.3$

Also,  $\log(x/y) = \log x - \log y$

(a) Using the Max Gain method, what is the best attribute for the root node of the decision tree? Show all your work. (8 marks)

(b) Construct the entire decision tree. (2 marks)

**End of Paper**